

Use Of MODIS Satellite Images And An Atmospheric Dust Transport Model To Evaluate *Juniperus Spp.* Pollen Phenology And Transport

J. C. Luvall^{a*}, W. A. Sprigg^b, E. Levetin^c, A. Huete^d, S. Nickovic^b, G. A. Pejanovic^b, A. Vukovic^b, P. K. Van de Water^c, O. B. Myers^f, A. M. Budge^g, A. P. Zelicoff^h, L. Bunderson^c, G. Ponce-Campos^b, T. M. Crimminsⁱ

^aNASA Marshall Space Flight Center Huntsville, AL 35812 - jluvall@nasa.gov

^bSchmid College of Science Chapman University University of Arizona, Tucson, AZ 85721- sprigg@chapman.edu

^cUniversity of Tulsa, Tulsa, OK 74104 - estelle-levetin@utulsa.edu

^dUniversity of Technology, Sydney, Australia, NSW - Alfredo.Huete@uts.edu.au

^eCalifornia State University, Fresno, Fresno, CA 93740 - pvandewater@csufresno.edu

^f[New Mexico Environmental Public Health Tracking, Albuquerque, NM](#) - omyers@salud.unm.edu

^gUniversity of New Mexico, Albuquerque, NM 87131 - abudge@edac.unm.edu

^h[ARES Corporation, Albuquerque, NM](#) - zalan8587@q.com

ⁱ[USA National Phenology Network, Tucson, AZ 85721](#) - theresam@u.arizona.edu

Pollen can be transported great distances. Van de Water et al., 2003 reported *Juniperus spp.* pollen, a significant aeroallergen was transported 200-600 km. Hence local observations of plant phenology may not be consistent with the timing and source of pollen collected by pollen sampling instruments. Direct detection of pollen via satellite is not practical. A practical alternative combines modeling and phenological observations using ground based sampling and satellite data.

The DREAM (Dust REgional Atmospheric Model) is a verified model for atmospheric dust transport modeling using MODIS data products to identify source regions and quantities of dust (Nickovic et al. 2001). The use of satellite data products for studying phenology is well documented (White and Nemani 2006). In the current project MODIS data will provide critical input to the PREAM model providing pollen source location, timing of pollen release, and vegetation type. We are modifying the DREAM model (PREAM - Pollen REgional Atmospheric Model) to incorporate pollen transport. The linkages already exist with DREAM through PHAiRS (Public Health Applications in Remote Sensing) to the public health community. This linkage has the potential to fill this data gap so that the potential association of health effects of pollen can better be tracked for possible linkage with health outcome data which may be associated with asthma, respiratory effects, myocardial infarction, and lost workdays.

Juniperus spp. pollen phenology may respond to a wide range of environmental factors such as day length, growing degree-days, precipitation patterns and soil moisture. Species differences are also important. These environmental factors vary over both time and spatial scales. Ground based networks such as the USA National Phenology Network have been established to provide national wide observations of vegetation phenology. However, the density of observers is not adequate to sufficiently document the phenology variability over large regions. Hence the use of satellite data is critical to observe *Juniperus spp.* pollen phenology.

MODIS data was used to observe *Juniperus spp.* pollen phenology. The MODIS surface reflectance product(MOD09) provided information on the Juniper spp. cone formation and cone density (Fig 1). Ground based observational records of pollen release timing and quantities were used as verification. Techniques developed using MOD09 surface reflectance products will be directly applicable to the next generation sensors such as VIIRS.